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Final Best Demonstrated Available Technology (BDAT) Background Document for K021. Volume 6

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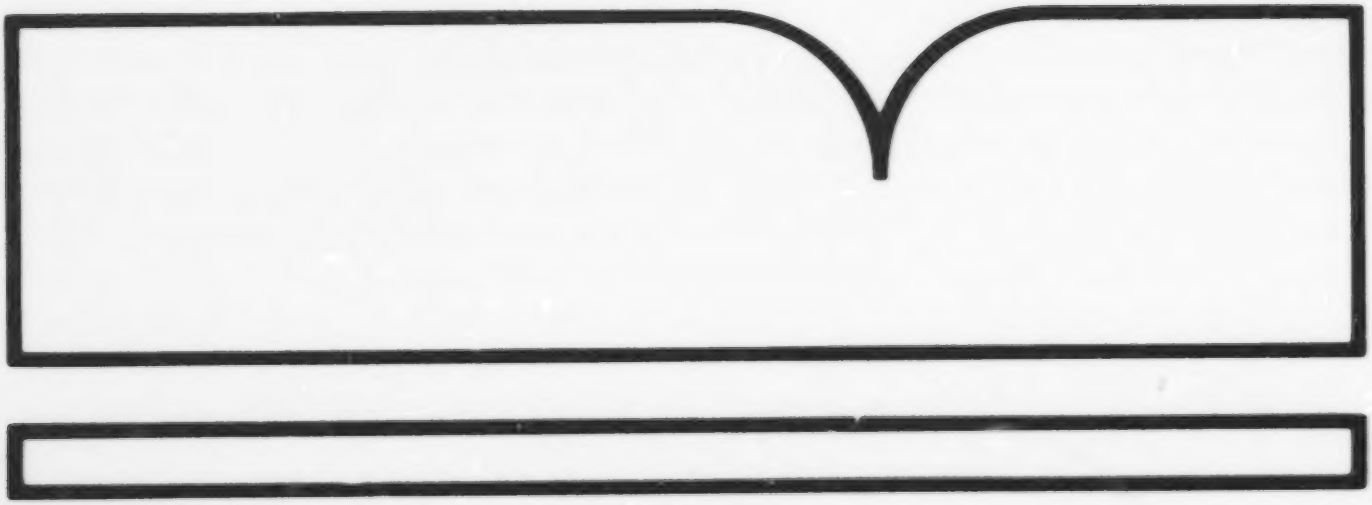

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FINAL
BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR

K021

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1. INTRODUCTION AND SUMMARY

Pursuant to section 3004(m) of the Resource Conservation and Recovery Act (RCRA) as enacted by the Hazardous and Solid Waste Amendments on November 8, 1984, the Environmental Protection Agency (EPA) is establishing best demonstrated available technology (BDAT) treatment standards for K021 waste (aqueous spent antimony catalyst waste from fluoromethanes production). Compliance with the BDAT treatment standards is a prerequisite for the placement of the waste in facilities designated as land disposal units according to 40 CFR Part 268. The effective date of the K021 treatment standards is August 8, 1990.

This background document provides the Agency's technical support and rationale for selecting and developing the treatment standards for the constituents to be regulated in K021 waste. This document explains how EPA determines BDAT, selects constituents for regulation, and calculates treatment standards. Section 2 presents waste-specific information--the number and location of facilities affected by the land disposal restrictions, the waste-generating process, and waste characterization data. These data serve as a basis for determining whether a variance from treatment standards may be warranted for a particular type of K021 that is more difficult to treat than the wastes that were analyzed in developing the treatment standards for K021. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated. The treatment standards are determined in Section 7.

The BDAT program, the Agency's legal authority, and promulgated methodology are described in detail in two additional documents: Methodology for Developing BDAT Treatment Standards (USEPA 1989a) and Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT") (USEPA 1987). The petition process to be followed in requesting a variance from the BDAT treatment standards is also discussed in the methodology document.

Under 40 CFR 261.32 wastes identified as K021 are listed as follows: aqueous spent antimony catalyst from fluoromethanes production. The Agency believes there are no facilities generating this waste.

Three constituents (carbon tetrachloride, chloroform, and antimony) are regulated in both nonwastewater and wastewater forms of K021 waste. For the purpose of determining the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1 percent (weight basis) total suspended solids* and less than 1 percent (weight basis) total organic carbon (TOC). Waste not meeting this definition must comply with the treatment standards for nonwastewaters.

The Agency does not have performance data for treatment of K021; therefore, the treatment standards for the regulated volatile organic constituents (carbon tetrachloride and chloroform) in nonwastewaters are transferred from treatment performance data from incineration of K019 waste. The treatment standards for the

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*The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, the quantity of total suspended solids is measured by Method 209c, Total Suspended Solids Dried at 103°105°C, in Standard Methods for the Examination of Water and Wastewater, 16th Edition (APHA, AWWA, and WPCF 1985).

regulated metal constituent (antimony) in nonwastewaters is transferred from treatment performance data from the stabilization of K048-K052. Additionally, applicable data for antimony in nonwastewater residuals are available from vitrification of arsenic and data from EPA's Office of Water are available for treatment of antimony in wastewater residuals.

For K021 wastewaters, BDAT treatment standards for organic constituents are based on treatment performance data transferred from EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for Wastewater Forms of Organic U and P Wastes and Multi-source Leachates (F039) for Which There Are Concentration-Based Treatment Standards, Volume A (USEPA 1990).

Table 1-1 lists the specific nonwastewater and wastewater treatment standards for K021 waste. The treatment standards for organics and metal wastewaters reflect the total constituent concentration; the units are mg/kg (parts per million on a weight-by-weight basis) for the nonwastewaters and mg/l (parts per million on a weight-by-volume basis) for the wastewaters. The units for leachate analysis are mg/l (parts per million on a weight-by-volume basis). Note that if the concentrations of the regulated constituents in the waste, as generated, are lower than or equal to the treatment standards, then treatment will not be required prior to land disposal.

Table 1-1 Treatment Standards for K021 Waste

Constituent	Nonwastewaters: Total concentration (mg/kg) (Grab sample)	Nonwastewaters: TCLP leachate concentration (mg/l) (Grab sample)	Wastewaters: Total concentration (mg/l) (Composite sample)
Volatile organics			
Carbon tetrachloride	6.2	NA	0.057
Chloroform	6.2	NA	0.046
Metals			
Antimony	NA	0.23	0.60

NA = Not applicable.

2. INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

According to 40 CFR 261.32, the K021 waste is defined as:

K021: Aqueous spent antimony catalyst waste from fluoromethanes production.

Commercial fluoromethane compounds actually are fluorinated chloromethane compounds; therefore, the term fluoromethane refers to chlorofluoromethane (or fluorochloromethane) compounds.

2.1 Industry Affected and Process Description

K021 waste was formerly generated by the industrial organic chemicals industry (Standard Industrial Classification (SIC) code 2869). The Agency, after consulting the 1986 National Survey of Treatment, Storage, and Recycling Facilities (TSDR Survey), knows of no facilities that currently generate K021 waste. The Agency has no current information on the process by which the waste is generated. The following description of the process was found in the RCRA Listing Background Document (USEPA 1980).

Chlorofluoromethanes are manufactured by the fluorination of chlorocarbons and are commonly used as refrigeration agents. The commercial products produced by this segment of the fluorocarbon industry include chlorotrifluoromethane ($CClF_3$), dichlorodifluoromethane (CCl_2F_2), trichlorofluoromethane (CCl_3F), and chlorodifluoromethane ($CHClF_2$).

Chlorofluoromethanes are manufactured by fluorinating either carbon tetrachloride (CCl_4) or chloroform ($CHCl_3$), using hydrogen fluoride (HF) and antimony pentachloride ($SbCl_5$) as catalysts (see Figure 2-1). Carbon tetrachloride is used as a starting material when trichlorofluoromethane (CCl_3F), dichlorodifluoromethane (CCl_2F_2), and chlorotrifluoromethane ($CClF_3$) are the desired products.

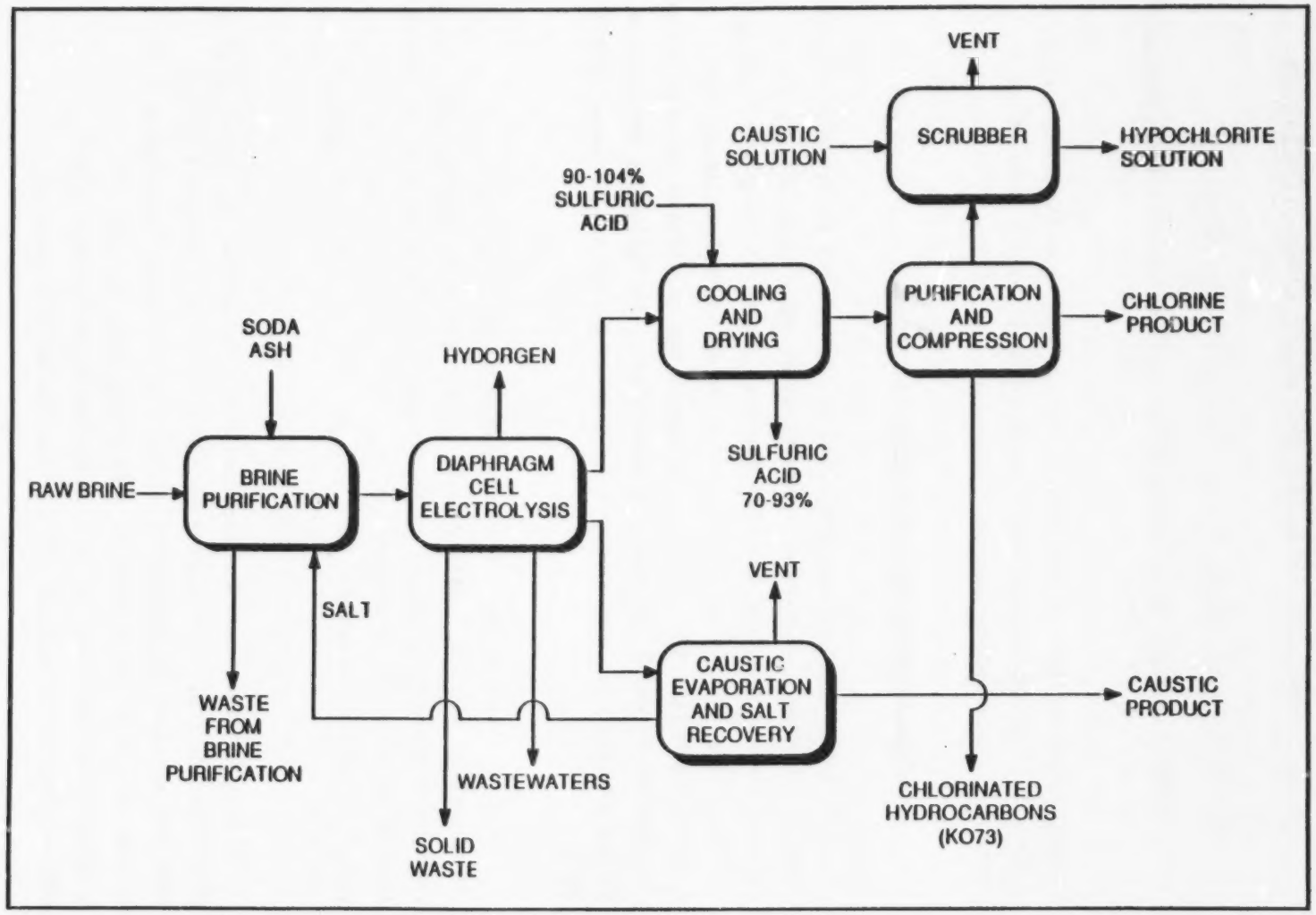

FIGURE 2-1. CHLOR-ALKALI MANUFACTURE DIAPHRAGM CELL PROCESS/GRAPHITE ANODES

Tetrafluoromethane (CF_4) is also formed as a coproduct waste. Chloroform is used as feedstock when chlorodifluoromethane ($CHClF_2$) and dichlorofluoromethane ($CHCl_2F$) are the desired products. Small amounts of trichlorotrifluoroethane ($C_2Cl_3F_3$) and trifluoromethane (CHF_3) are formed as coproduct wastes.

In both processes, the chlorine in the starting materials is successively replaced with fluorine. For example, starting with carbon tetrachloride (CCl_4) and hydrogen fluoride, the reaction is carried out continuously to produce the product mix desired, usually a 50/50 blend of trichlorofluoromethane (CCl_3F) and dichlorodifluoromethane (CCl_2F_2), as illustrated by the following equations:

(1) $CCl_4 + HF \dashrightarrow Cl_3C\text{-}F + HCl$

(2) $Cl_3C\text{-}F + HF \dashrightarrow CCl_2F_2 + HCl$

The unit operations of the process are detailed in Figure 2-1. In generating the listed waste K021, the antimony pentachloride catalyst ($SbCl_5$) is reduced to antimony trichloride ($SbCl_3$). A slip stream is taken from (A) (see Figure 2-1) to remove a portion of the spent catalyst. After washing, the aqueous spent catalyst waste (B) is sent to pits (C) where it is either disposed of or stored until further treatment. (The bulk of the antimony trichloride is recovered by the catalyst filter, dried, and reactivated by chlorination to form antimony pentachloride, which is recycled to the fluorinator.)

2.2 Waste Characterization

Limited compositional data on K021 are available from the RCRA Listing Background Document (USEPA 1980) and the generator survey. These data indicate that chloroform, carbon tetrachloride, and antimony are the constituents of concern in K021 waste. No approximate percentages of the amounts of these constituents are given for K021.

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section identifies the treatment technologies that are applicable to K021 waste and determines which, if any, of the applicable technologies can be considered demonstrated for the purposes of establishing BDAT.

To be applicable, a technology must be theoretically usable to treat the waste in question, or to treat a waste that is similar in terms of the parameters that affect treatment selection. (For detailed descriptions of the technologies applicable for these wastes, or for wastes judged to be similar, see EPA's Treatment Technology Background Document (USEPA 1989b).) To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at research facilities or in pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

As explained in Section 2.2, K021 waste is believed to contain primarily organic constituents and antimony. Applicable technologies for organic constituents in a waste or in any resulting treatment residuals include technologies that recover, destroy or, reduce the amount of the constituents in the waste. Applicable technologies for metals could include those that remove or prevent migration of metal constituents from a waste.

The Agency has identified fuel substitution and incineration as applicable technologies for treating the organic constituents in untreated K021 nonwastewaters. These treatment technologies were identified based on current literature sources, field testing, and

current waste treatment practices. As treatment processes, fuel substitution and incineration have the same purpose: to thermally destroy the organic constituents in the waste by converting them to carbon dioxide and water. Fuel substitution, in addition, uses the waste as a substitute for conventional fuels burned in high-temperature industrial processes. Both fuel substitution and incineration generally result in nonwastewater and wastewater treatment residuals such as ash, clarifier solids from the flue gas scrubber system, and scrubber water. The residuals from treatment of K021 nonwastewaters in a well-designed, well-operated fuel substitution combustion device or incinerator are not expected to contain detectable levels of organic constituents and thus should not require further treatment for organics.

Since wastewater forms of K021 wastes contain hazardous organic constituents at treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the wastewater. Therefore, the Agency has identified the following treatment technologies as potentially applicable for treatment of these wastes:

- Biological Treatment (including aerobic fixed film, aerobic lagoons, activated sludge, anaerobic fixed film, rotating biological contractor, sequential batch reactor, and trikling filter technologies);

- PACT^{R} Treatment (including powdered activated carbon addition to activated sludge and biological granular activated carbon technologies);

- Carbon Adsorption Treatment (including activated carbon and granular activated carbon technologies);

- Solvent Extraction Treatment (including liquid, liquid extracting technology);
- Chemical Oxidation Treatment;
- Wet Air Oxidation Treatment (including super critical oxidation technology);
- Stripping Treatment (including steam stripping and air stripping technologies);
- Reverse Osmosis Treatment; and
- Chemically Assisted Clarification Treatment (including chemical precipitation technology).

These technologies are explained in detail in the BDAT background document for U and P wastes (USEPA 1990b).

Because K021 waste contains antimony, a BDAT list metal, residuals are expected to contain treatable levels of antimony. Therefore, stabilization and vitrification for nonwastewaters and chemical precipitation for wastewaters are considered applicable technologies for the treatment of antimony in K021 waste. Additionally, a treatment train of lime conditioning followed by sedimentation and filtration is applicable for antimony treatment in wastewaters according to the proposed best demonstrated available technology (BDAT) Background Document for Third Third U and P Wastes and Multi-Source Leachates (USEPA 1990).

Stabilization is a treatment technology applicable to wastes containing leachable metals and having a high filterable solids content, low total organic carbon (TOC) content, and low oil and grease content.

It is commonly used to treat incinerator ash that leaches metals. In stabilization, leachable metals in a waste are immobilized following the addition of stabilizing agents and other chemicals.

Vitrification is a process wherein waste or a wastewater solution is blended into a mixture of lime, soda ash, silica, and other ingredients normally used for glass-making. Waste may also be blended into metallurgical slags. The blended waste and glass or slag constituent mixture is then fed to a glass-making or other appropriate furnace. In glassmaking, material is normally introduced to the top of the furnace and falls to the surface of a pool of molten glass maintained at 1100° to 1200°C. At these temperatures organic constituents of the waste are combusted, and inorganic constituents dissolve into the glass melt. Molten glass is withdrawn from the base of the furnace and cooled into chunks or blocks. The waste inorganic constituents become physically and chemically incorporated into the glass matrix and leaching is reduced.

Chemical precipitation is a treatment technology applicable to wastewaters containing a wide range of dissolved and other metals. This technology removes these metals from solution in the form of insoluble solid precipitates. The solids are then separated from the wastewater by settling, clarification, and/or polishing filtration.

3.2 Demonstrated Technologies

There are currently no known generators of K021 waste; therefore, the Agency has no data indicating that incineration or fuel substitution is currently being used on K021 nonwastewater. The Agency does have data, however, on incineration of K019, a waste believed to be similar to K021. Both K019 and K021 are generated by the organic chemicals industry and contain similar constituents. Both chloroform and carbon tetrachloride, the organic constituents of concern in K021, are present

at treatable levels in K019. The Agency believes, therefore, that incineration would be a demonstrated technology for K021 nonwastewater.

The Agency has no evidence that fuel substitution is being used on wastes having similar chlorinated organic concentrations. When chlorinated hydrocarbons are combusted, hydrogen chloride gas or chlorine gas may be produced. These may not be compatible with normal fuel uses in industrial furnaces or boilers, in that the gases may be corrosive to furnace material of construction or not compatible with furnace product quality. Thus EPA does not believe that fuel substitution would be a demonstrated technology for K021 nonwastewater. Incineration, therefore, is the only demonstrated technology for organics removal in K021 nonwastewater.

To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

All of the technologies identified as applicable for K021 wastewaters have been demonstrated in full-scale operation for treatment of wastewaters containing these various constituents or similar constituents. The Agency, therefore, believes that all of the technologies presented in Section 3.1 should be considered for use in determining BDAT.

The Agency has no data indicating that chemical precipitation is being used on K021 waste or on any other waste containing antimony. Chemical precipitation is, therefore, not a demonstrated technology for removal of antimony from wastewaters. Additionally, the Agency has no data to indicate that stabilization is being used on K021 waste or any

other waste with treatable concentrations of antimony. Only inconclusive data are available on antimony stabilization for K048-K052 (see Table 4-8). These data show the concentration of antimony increasing after stabilization. Therefore, stabilization is not considered to be a demonstrated technology for metals treatment in K021 nonwastewaters. Data are available for the slag vitrification of arsenic in the background document for arsenic and selenium wastes (USEPA 1990a), and the Agency believes these data are applicable and demonstrated for antimony in nonwastewater residuals. Additionally, the Agency has searched available literature (Tooley 1984) and learned that antimony oxide (Sb_2O_3) is often in vitrified in concentrations up to 1 percent in glassmaking.

Consequently, the only demonstrated treatment technology for antimony-containing nonwastewaters is vitrification. There are no demonstrated treatment technologies for antimony-containing wastewaters.

4. PERFORMANCE DATA

This section presents the data available to EPA on the performance of demonstrated technologies in treating the listed wastes. These data are used elsewhere in this document for determining which technologies represent BDAT (Section 5), for selecting constituents to be regulated (Section 6), and for developing treatment standards (Section 7). Eligible data, in addition to full-scale demonstration data, may include data developed at research facilities or obtained through other applications at less than full-scale operation, as long as the technology is demonstrated in full-scale operation for a similar waste or wastes as defined in Section 3.

Performance data, to the extent that they are available to EPA, include the untreated and treated waste concentrations for a given constituent, values of operating parameters that were measured at the time the waste was being treated, values of relevant design parameters for the treatment technology, and data on waste characteristics that affect performance of the treatment technology.

Where data are not available on the treatment of the specific wastes of concern, the Agency may elect to transfer data on the treatment of a similar waste or wastes, using a demonstrated technology. To transfer data from another waste category, EPA must find that the wastes covered by this background document are no more difficult to treat (based on the waste characteristics that affect performance of the demonstrated treatment technology) than the treated wastes from which performance data are being transferred.

No performance data are available to the Agency to characterize treatment for K021. However, the Agency has data for incineration of a similar organic waste, K019, which, as defined by 40 CFR 261.32, is the

heavy ends from the distillation of ethylene dichloride in ethylene dichloride production. This similarity is based on the production processes, the waste compositions, and the waste characteristics affecting performance of the demonstrated treatment technology. Both K019 and K021 are produced by using a hydrogen halide or halogen feedstock and distilling until the desired product is formed. (Section 2 of this background document details the K021 process description; Section 2 of the K019 background document (USEPA 1988a) presents the K019 process description.) K021 is expected to contain chloroform and carbon tetrachloride in high quantities, constituents that are also present in K019. As discussed in the Treatment Technology Background Document (USEPA 1989b), the waste characteristics affecting performance of incineration are thermal conductivity of the waste and the boiling points and bond dissociation energies of the constituents of concern. Evaluation of the waste composition for K021 reveals that the primary constituents of concern in K021 (i.e., chloroform and carbon tetrachloride) have boiling points and bond dissociation energies lower than those of most constituents present in K019. (See Tables 4-1 through 4-6.) Therefore, the Agency is transferring performance data for organics from the treatment of K019 to the K021 nonwastewaters since the Agency believes that K021 is no more difficult to treat than the tested K019 waste.

The performance data for K019 waste include the untreated and treated waste concentrations for certain constituents, the values of operating parameters that were measured at the time the waste was being treated, the values of relevant design parameters for the treatment technology tested, and data on waste characteristics that affect the performance of the treatment technology.

Treatment standards for organic BDAT List Constituents in K021 wastewaters were developed from treatment performance data transferred from EPA's Final Best Demonstrated Available Technology (BDAT) Background Docufment for Wastewater Forms of Organic U and P Wastes and Multi-source Leachates (F039) for Which They are Concentration-Based Treatment Standards, Volume A (USEPA 1990b).

Treatment performance data from Volume a (USEPA 1990b) are presented in Appendix A. These data were used for transfer to K021 wastewaters bvecause when the Agency has appropriate wastewater treatment data from well-designed and well-operated wastewater treatment units, it prefers to use these data rather than scrubber water concentrations in setting BDAT treatment standards. Additionally, these data represent a specific wastewater treatment technology as opposed to incineration scrubber water.

Tables 4-1 through 4-6 present the data for BDAT list constituent analyses for treated and untreated K019 waste, as well as the design and operating data for the incineration treatment system. Based on a review of the operating data obtained during collection of the samples, the data sets appear to reflect treatment by a well-operated system. This is further evidenced by the fact that in all cases the BDAT list organics detected in the K019 untreated waste are reduced to nondetectable levels in the treated residuals.

The tables in Appendix A present the data from Volume A of the Best Demonstrated Available Technology (BDAT) Background Document for Third Third U&P Wastes and Multi-Source Leachates (USEPA 1990b). These data were used to develop treatment standards for K021 wastewaters.

Because one BDAT list metal, antimony, is expected to be present in the untreated K021 waste, it is also expected to be found in K021

treatment residuals, (i.e., incinerator ash, incinerator scrubber water, and stack gas). No performance data are available for treatment of antimony in K021 wastewaters and nonwastewaters, and inconclusive performance data are available for treatment of antimony in all other waste codes for which EPA has treatment data. Some of these inconclusive data for treatment of antimony from K048-K052 appear in Table 4-7. Also, data from the vitrification of arsenic appear in Table 4-8, and these data may be used for treatment of antimony in nonwastewater residuals.

Table 4-1 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,000	<8	<2
9. Chlorobenzene	3,000	<8	<2
14. Chloroform	4,600	<8	<2
22. 1,1-Dichloroethane	2,200	<8	<2
23. 1,2-Dichloroethane	93,000	<8	<2
34. Methyl ethyl ketone	<1,000	940	<10
38. Methylene chloride	<1,000	910	<10
42. Tetrachloroethene	7,300	490	<2
43. Toluene	<200	2,300	<2
45. 1,1,1-Trichloroethane	81,000	130	<2
47. Trichloroethene	3,210	360	<2
215-217. Xylene (total)	<200	3,400	<2
222. Acetone	<1,000	1,200	<10
226. Ethyl benzene	<200	2,200	<2
229. Methyl isobutyl ketone	<1,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	280	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	81	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	20	53	<2
110. Hexachlorobenzene	69	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-1 (Continued)

SAMPLE SET #1 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln As TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	120	<100	<10	
121. Naphthalene	470	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	61.	<100	<10	
141. Phenanthrene	21	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	76	<50	<5	
150. 1,2,4-Trichlorobenzene	100	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	8.0	<0.060
155. Arsenic	1.2	94	3.6	<0.002
156. Barium	0.97	1.3	26	0.033
158. Cadmium	0.63	<0.3	0.66	<0.003
159. Chromium	4.0	40	44	0.200
160. Copper	2.1	165	2,370	2.690
161. Lead	3.4	27	120	0.380
163. Nickel	3.0	8.8	66	0.680
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	4.1	<0.020
168. Zinc	5.8	4,170	12	0.052
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	38	
171. Sulfide	790	830	68	

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-1 (Continued)

SAMPLE SET #1 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)-	*	1825-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)-	*	K019: 13.1 RCRA Blend, Waste Burner #1: 3.9-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-2 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Wast Kiln Asn Concentratic mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,800	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,800	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	96,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	6,700	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	33,000	130	<2
47. Trichloroethene	2,400	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	280	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	74	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	16	53	<2
110. Hexachlorobenzene	60	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-2 (Continued)

SAMPLE SET #2 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)	Treated Waste Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	85	<100	<10	
121. Naphthalene	314	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	51	<100	<10	
141. Phenanthrene	15	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	62	<50	<5	
150. 1,2,4-Trichlorobenzene	65	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	6.8	<0.060
155. Arsenic	<0.2	94	2.8	<0.002
156. Barium	<0.9	1.3	23	0.036
158. Cadmium	0.46	<0.3	0.96	0.004
159. Chromium	3.4	40	60	0.130
160. Copper	1.7	165	3,430	2.380
161. Lead	2.3	27	42	0.260
163. Nickel	3.6	8.8	89	0.560
165. Silver	<0.9	<0.9	3.4	<0.009
167. Vanadium	<2.0	2.2	4.8	<0.020
168. Zinc	6.9	4,170	13	0.07?
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	5.1	
171. Sulfide	NA	830	<50	

NA Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-2 (Continued)

SAMPLE SET #2 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)+	*	1800-1880
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 12.2 RCRA Blend, Waste Burner #1: 5.2-5.5 RCRA Blend, Waste Burner #2: 4.4-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-3 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Asn Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,500	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	87,000	940	<10
34. Methyl ethyl ketone	<10,000	910	<10
38. Methylene chloride	<10,000	490	<2
42. Tetrachloroethene	6,000	2,300	<2
43. Toluene	<2,000	130	<2
45. 1,1,1-Trichloroethane	34,000	360	<2
47. Trichloroethene	2,200	3,400	<2
215-217. Xylene (total)	<2,000	1,200	<10
222. Acetone	<10,000	2,200	<2
226. Ethyl benzene	<2,000	1,100	<10
229. Methyl isobutyl ketone	<10,000		
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	290	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	80	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	73	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-3 (Continued)

SAMPLE SET #3 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Asn Concentration mg/kg (ppm)	Treated Waste Kiln Asn TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	95	<100	<10	
121. Naphthalene	350	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	59	<100	<10	
141. Phenanthrene	11	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	67	<50	5	
150. 1,2,4-Trichlorobenzene	70	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.2	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	54	0.057
158. Cadmium	0.53	<0.3	3.6	0.005
159. Chromium	3.5	40	202	0.260
160. Copper	1.7	165	2,290	7.030
161. Lead	3.4	27	118	0.620
163. Nickel	2.3	8.8	169	0.960
165. Silver	<0.9	<0.9	1.9	<0.009
167. Vanadium	<2.0	2.2	6.0	<0.020
168. Zinc	4.4	4,170	16	0.170
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	6.1	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-3 (Continued)

SAMPLE SET #3 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)-	*	1850-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)-	*	K019: 12.4
		RCRA Blend, Waste Burner #1: 5.2-5.8
		RCRA Blend, Waste Burner #2: 4.4-8.4
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-4 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Wast: Kiln Asn Concentratic mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	3,900	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,300	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	122,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,200	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	44,000	130	<2
47. Trichloroethene	2,300	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	310	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	12
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	84	32	<2
98. Di-n-butyl phthalate	<10	31	230
108. Fluoranthene	<10	120	<2
109. Fluorene	21	53	<2
110. Hexachlorobenzene	61	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-4 (Continued)

SAMPLE SET #4 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Waste Kiln Ash Concentration mg/kg (ppm)	Treated Waste Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	94	<100	<10	
121. Naphthalene	360	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	64	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	82	<50	<5	
150. 1,2,4-Trichlorobenzene	74	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	<6.0	<0.060
155. Arsenic	<0.2	94	5.7	<0.002
156. Barium	<0.9	1.3	8.4	0.036
158. Cadmium	<0.3	<0.3	<0.3	0.005
159. Chromium	1.8	40	28	0.110
160. Copper	<1.0	165	1,270	1.940
161. Lead	2.4	27	25	0.320
163. Nickel	2.2	8.8	69	0.870
165. Silver	<0.9	<0.9	2.6	<0.009
167. Vanadium	<2.0	2.2	<2.0	<0.020
168. Zinc	9.4	4,170	11	0.056
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	3.2	
171. Sulfide	NA	830	<50	

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-4 (Continued)

SAMPLE SET #4 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)+	*	1775-1900
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	KO19: 12.7 RCRA Blend, Waste Burner #1: 5.2-5.8 RCRA Blend, Waste Burner #2: 4.4-7.3
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-5 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,000	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	6,000	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	130,000	<8	<2
34. Methyl ethyl ketone	<10,000	940	<10
38. Methylene chloride	<10,000	910	<10
42. Tetrachloroethene	7,800	490	<2
43. Toluene	<2,000	2,300	<2
45. 1,1,1-Trichloroethane	45,000	130	<2
47. Trichloroethene	2,500	360	<2
215-217. Xylene (total)	<2,000	3,400	<2
222. Acetone	<10,000	1,200	<10
226. Ethyl benzene	<2,000	2,200	<2
229. Methyl isobutyl ketone	<10,000	1,100	<10
SEMIVOLATILES			
51. Acenaphthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	340	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	19	53	<2
110. Hexachlorobenzene	87	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-5 (Continued)

SAMPLE SET #5 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: K019 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Ash Concentration mg/kg (ppm)	Treated Waste: Kiln Ash TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	113	<100	<10	
121. Naphthalene	371	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	63	<100	<10	
141. Phenanthrene	19	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	73	<50	<5	
150. 1,2,4-Trichlorobenzene	72	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.1	<0.060
155. Arsenic	<0.2	94	3.9	<0.002
156. Barium	<0.9	1.3	21	0.054
158. Cadmium	0.36	<0.3	1.2	0.006
159. Chromium	3.2	40	125	0.210
160. Copper	2.1	165	2,780	2.140
161. Lead	2.5	27	86	0.290
163. Nickel	4.8	8.8	166	1.270
165. Silver	<0.9	<0.9	3.3	<0.009
167. Vanadium	<2.0	2.2	5.7	<0.020
168. Zinc	4.7	4,170	22	0.086
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	23	
171. Sulfide	NA	830	64	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-5 (Continued)

SAMPLE SET #5 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (°F)+	*	1775-1800
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)+	*	K019: 11.7 RCRA Blend, Waste Burner #1: 5.5-6.0 RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-6 TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6

Detected BDAT List Organic Constituents	Untreated Waste K019 Concentration mg/kg (ppm)	Untreated Waste RCRA Blend* Concentration mg/kg (ppm)	Treated Was Kiln Ash Concentrati mg/kg (ppm)
VOLATILES			
4. Benzene	<2,000	2,000	<2
7. Carbon tetrachloride	4,100	<8	<2
9. Chlorobenzene	<2,000	<8	<2
14. Chloroform	5,600	<8	<2
22. 1,1-Dichloroethane	<2,000	<8	<2
23. 1,2-Dichloroethane	98,000	940	<10
34. Methyl ethyl ketone	<10,000	910	<10
38. Methylene chloride	<10,000	490	<2
42. Tetrachloroethene	6,900	2,300	<2
43. Toluene	<2,000	130	<2
45. 1,1,1-Trichloroethane	44,000	360	<2
47. Trichloroethene	2,500	3,400	<2
215-217. Xylene (total)	<2,000	1,200	<10
222. Acetone	<10,000	2,200	<2
226. Ethyl benzene	<2,000	1,100	<10
229. Methyl isobutyl ketone	<10,000		
SEMIVOLATILES			
51. Acenapthalene	<10	150	<2
57. Anthracene	<10	110	<2
65. Benzo(k)fluoranthene	<10	67	<2
68. Bis(2-chloroethyl) ether	330	<20	<2
70. Bis(2-ethylhexyl) phthalate	<10	40	<2
80. Chrysene	SNA	28	<2
87. o-Dichlorobenzene	<10	250	<2
88. p-Dichlorobenzene	90	32	<2
98. Di-n-butyl phthalate	<10	31	<2
108. Fluoranthene	<10	120	<2
109. Fluorene	22	53	<2
110. Hexachlorobenzene	66	<100	<10

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-6 (Continued)

SAMPLE SET #6 (Continued)

Detected BDAT List Organic Constituents	Untreated Waste: KO19 Concentration mg/kg (ppm)	Untreated Waste: RCRA Blend* Concentration mg/kg (ppm)	Treated Waste: Kiln Asn Concentration mg/kg (ppm)	Treated Waste: Kiln Asn TCLP mg/L (ppm)
SEMIVOLATILES (Continued)				
111. Hexachlorobutadiene	<50	210	<10	
113. Hexachloroethane	88	<100	<10	
121. Naphthalene	390	<20	<2	
126. Nitrobenzene	<25	3,400	<5	
136. Pentachlorobenzene	65	<100	<10	
141. Phenanthrene	17.	240	<2	
142. Phenol	<10	78	<2	
145. Pyrene	<10	200	<2	
148. 1,2,4,5-Tetrachlorobenzene	86	<50	<5	
150. 1,2,4-Trichloroenzene	79	<50	<5	
Detected BDAT List Metal and Inorganic Constituents				
METALS				
154. Antimony	<6.0	24	9.6	< 0.06
155. Arsenic	<0.2	94	2.3	<0.002
156. Barium	<0.9	1.3	11	0.027
158. Cadmium	0.62	<0.3	2.2	0.006
159. Chromium	5.3	40	141	0.092
160. Copper	3.6	165	2,520	2.400
161. Lead	3.5	27	34	0.270
163. Nickel	6.0	8.8	288	0.690
165. Silver	<0.9	<0.9	3.1	<0.009
167. Vanadium	<2.0	2.2	8.7	<0.020
168. Zinc	8.4	4,170	13	0.061
INORGANICS				
169. Total Cyanide	<0.5	0.9	<0.47	
170. Fluoride	<5.0	31	4.7	
171. Sulfide	NA	830	92	

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 4-6 (Continued)

SAMPLE SET #6 (Continued)

DESIGN AND OPERATING PARAMETERS

Parameter	Design	Operating Value
Kiln Temperature (^{o}F)-	*	1775-1850
Kiln Solids Residence Time (min)	*	120
Waste Feed Rate (MMBTU/hr)-	*	K019: 11.5
		RCRA Blend, Waste Burner #1: 5.2-5.8
		RCRA Blend, Waste Burner #2: 5.2-9.7
Kiln Rotational Speed (RPM)	*	0.19-0.21

*This information has been claimed as RCRA Confidential Business Information.

Table 4-7 **TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K048 AND K051 PLANT I - STABILIZATION OF INCINERATOR ASH**

Detected BDAT List Metal Constituents		Untreated Waste TCLP Extracts of K048 and K051 Incinerator Ash	Treated Waste TCLP Extracts of Stabilized Fluidized Bed Incinerator Ash								
			Cement Binder			Kiln Dust Binder			Lime and Fly Ash Binder		
			Run 1 mg/L (ppm)	Run 2 mg/L (ppm)	Run 3 mg/L (ppm)	Run 1 mg/L (ppm)	Run 2 mg/L (ppm)	Run 3 mg/L (ppm)	Run 1 mg/L (ppm)	Run 2 mg/L (ppm)	Run 3 mg/L (ppm)
154.	Antimony	0.06-0.09	<0.163	<0.163	<0.163	<0.163	0.178	<0.163	<0.163	<0.163	<0.163
155.	Arsenic	0.008-0.025	<0.004	<0.004	<0.004	0.005	0.005	0.005	<0.004	<0.004	0.006
156.	Barium	0.17-0.25	0.277	0.28	0.278	0.203	0.2	0.204	0.558	0.524	0.599
157.	Beryllium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
158.	Cadmium	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
159.	Chromium (total)	2.1-2.6	2.11	2.12	2.16	1.78	1.92	1.87	1.13	1.21	1.08
221.	Chromium (hexavalent)	NA	0.415	0.326	2.47	0.38	0.395	2.13	0.331	0.259	0.071
160.	Copper	0.02	<0.003	<0.003	0.015	<0.003	<0.003	<0.003	<0.003	<0.003	0.006
161.	Lead	<0.05	<0.006	<0.006	0.011	0.02	0.009	<0.006	<0.006	<0.006	<0.006
162.	Mercury	0.0002-0.0003	NA	NA	NA	NA	NA	NA	NA	NA	NA
163.	Nickel	0.02-0.03	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
164.	Selenium	0.033-0.12	0.025	0.022	0.024	0.044	0.043	0.04	0.013	0.016	0.017
165.	Silver	<0.009	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
166.	Thallium	NA	<0.001	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
167.	Vanadium	2.5-3.6	1.4	1.21	1.29	1.53	1.64	1.56	0.148	0.149	0.156
168.	Zinc	0.055-0.11	0.058	0.047	0.086	0.048	0.042	0.031	0.02	0.022	0.052

NA = Not analyzed.

Table 4-7 (Continued)

Design and Operating Parameters	Stabilization Process								
	Cement			Kiln Dust			Lime and Fly Ash		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Binder to Ash Ratio	0.2	0.2	0.2	0.2	0.2	0.2	NP	NP	NP
Lime to Ash Ratio	NP	NP	NP	NP	NP	NP	0.2	0.2	0.2
Fly Ash to Ash Ratio	NP	NP	NP	NP	NP	NP	0.2	0.2	0.2
Water to Ash Ratio	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Ambient Temperature (^{o}C)	23	23	23	19	19.5	20	19	19	19
Mixture pH	11.6	11.5	11.5	12.1	12.1	12.1	12.0	12.1	12.1
Cure Time (Days)	28	28	28	28	28	28	28	28	28
Unconfined Compressive Strength (lb/in^2)	943.5	921.6	1270	222.8	267.7	241.0	565.8	512.6	578.8

NP = Not applicable.

Table 4-8 EPA-Designated Toxicity Test Applied to Vitrified Slags Containing Arsenic

Arsenic in slag (%)	Analysis of leach solution for arsenic from EP toxicity test (mg/l)
0.3	0.007
0.54	0.016
0.77	0.047
2.1	0.448
3.3	0.421
5.2	0.902
9.0	0.337
9.1	0.415
12.4	0.115
13.7	0.308
16.4	0.377
19.4	0.802
20.7	0.846
23.5	1.791

EPA-specified concentration of arsenic for designation as a characteristic toxic material is 5 mg/l.

Source: Twidwell and Mehta 1985.

5. DETERMINATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for determining best demonstrated available technology (BDAT) for K021 nonwastewaters and wastewaters.

To determine BDAT, the Agency examines all available performance data on technologies that are identified as demonstrated on the waste of concern or similar wastes to determine (using statistical techniques) whether one or more of the technologies performs significantly better than the others. All performance data used for determination of best technology must first be adjusted for accuracy, as discussed in EPA's publication Methodology for Developing BDAT Treatment Standards. (An accuracy adjustment accounts for the ability of an analytical technique to recover a particular constituent from the waste in a particular test. The recovery of a constituent is usually determined by spiking a sample with a known amount of the target constituent and then comparing the spiked sample amounts with results from unspiked samples.) BDAT must be specifically defined for all streams associated with the management of the listed waste or wastes; this pertains to the original waste as well as any residual waste streams created by the treatment process. Additionally, the ANOVA test is available to compare data from two or more demonstrated technologies and determine which offers the best treatment. The ANOVA test is described fully in the methodology background document (USEPA 1989a).

The technology that performs best, based on ANOVA tests, on a particular waste or waste treatability group is then evaluated to determine whether it is "available." To be available, the technology must (1) be commercially available to any generator and (2) provide "substantial" treatment of the waste, as determined through evaluation of accuracy-adjusted data. In determining whether treatment is substantial, EPA may consider data on the performance of a waste similar to the waste

in question provided that the similar waste is at least as difficult to treat. If the best technology is found to be not available, then the next best technology is evaluated, and so on.

5.1 BDAT for Organics

The determination of substantial treatment of organics involves comparing constituent concentrations in the original waste to the respective concentrations in all residual streams from treatment. No performance data are available for organics in the K021 waste as generated, but because of its similarity to K019 the Agency believes the "best" technology chosen for K019, incineration, would be applicable to K021. Incineration of K021 waste as generated (a nonwastewater) will result in two different treatment residues, scrubber water (wastewater) and incinerator ash (nonwastewater). These residues should be devoid of organic constituents; that is, the organic constituents will be present in amounts below than the detection limit.

EPA has determined in Section 3 that incineration is demonstrated on wastes similar to K021. Also, EPA believes that incineration provides substantial treatment for organics because the performance data for K019 show that untreated concentrations of constituents with higher boiling points than those of constituents regulated in K021 can be reduced to nondetectable levels in both the residual nonwastewater ash and the residual wastewater stream (the scrubber water). Thus, incineration is selected as "best" for organic constituents in K021 wastes.

As "best," "demonstrated," and "available," incineration is therefore BDAT for organics in K021 wastes.

5.2 BDAT for Metals

As discussed in Section 3, there are no demonstrated technologies for antimony treatment in K021 wastewaters. The Agency is, therefore, not

choosing a BDAT for metals treatment in K021 wastewaters. The method of choosing regulatory levels for antimony in K021 wastewaters without a demonstrated technology is explained in Section 7.

EPA has determined in Section 3 that vitrification is an applicable and demonstrated technology for antimony in K021 nonwastewater residuals. Also, EPA believes that vitrification for antimony provides substantial treatment because antimony levels are reduced to the EP-Toxicity level for arsenic. Additionally, vitrification yields residues with minimal hazardous properties. Therefore, EPA believes that vitrification is BDAT for antimony in nonwastewater residuals of K021. EPA also is choosing a numerical level for antimony in nonwastewaters based on stabilization performance data from K048-K052. This method of choosing a numerical standard for antimony without a demonstrated technology is outlined in Section 7.

6. SELECTION OF REGULATED CONSTITUENTS

This section presents the methodology and rationale for the selection of regulated constituents for the treatment of K021.

Generally, constituents selected for regulation must satisfy the following criteria:

1. They must be on the BDAT list of regulated constituents. (Presence on the BDAT list implies the existence of approved techniques for analyzing the constituent in treated waste matrices.)

2. They must be present in, or be suspected of being present in, the untreated waste. For example, in some cases, analytical difficulties (such as masking) may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.

3. Where performance data are transferred, the selected constituents must be easier to treat than the waste constituent(s) from which performance data are transferred. Factors for assessing ease of treatment vary according to the technology of concern. For instance, for incineration the factors include bond dissociation energy, thermal conductivity, and boiling point.

From the group of constituents that are eligible to be regulated (i.e., all constituents on the BDAT List), EPA may select a subset of constituents as representative of the broader group. For example, out of a group of constituents that react similarly to treatment, the Agency might name only those that are the most difficult to treat as regulated constituents for the purpose of setting a standard.

6.1 Identification of BDAT List Constituents

As discussed in Sections 2 and 4, the Agency has no performance data from treatment of organics in K021 waste by incineration. Compositional

data for this waste were obtained from the RCRA Listing Background Document. Performance data for organics are available for K019, which the Agency believes is similar to K021 and therefore represents a source of transfer. The Agency is using these data as the best source of data for transfer. These data, along with information on the K021 waste-generating process, have been used to determine which BDAT list constituents are or may be present in the waste and thus which ones are potential candidates for regulation. Both K021 and K019 contain carbon tetrachloride and chloroform, the primary constituents of concern in K021. Table 6-1 indicates, for the untreated waste, three constituents that the Agency believes are likely to be present in K021, based on listing information. These three constituents (carbon tetrachloride, chloroform, and antimony) were considered as candidates for regulation.

6.2 Constituent Selection

The Agency is regulating the two organic BDAT list constituents believed to be present in K021--carbon tetrachloride and chloroform.

The Agency is also regulating antimony, the only BDAT list metal believed to be present.

Table 6-1 Candidates for Regulation in K021 Waste

Constituent
Volatile organics
Carbon tetrachloride[a]
Chloroform[a]
Metals
Antimony[a]

[a] These constituents are selected for regulation.

7. CALCULATION OF BDAT TREATMENT STANDARDS

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available performance data and must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures.

Concentration-based BDAT standards are determined for each constituent by multiplying the arithmetic mean of accuracy-adjusted constituent concentrations detected in the treated waste by a "variability factor" specific to each constituent. Accuracy adjustment of performance data is discussed later in this section. EPA's publication Methodology for Developing BDAT Treatment Standards details both accuracy adjustment and the determination and use of variability factors.

Where EPA has identified BDAT for a particular waste, but because of data limitations or for some other compelling reason cannot define specific treatment standards for that waste, the Agency can require the use of that treatment process as a technology standard.

In the case of K021 waste, the Agency is setting treatment standards for the volatile organic and metal constituents shown in Tables 7-1 and 7-2 at the end of this section. The organic treatment standards are based on performance data from the incineration of K019 waste (see Tables 4-1 through 4-6). The wastewater metal standards are also based on incineration of K019. For nonwastewater metal residuals, standards are based on either slag vitrification of arsenic or stabilization of K048-K052 ash (see Tables 4-7 and 4-8).

As discussed in Sections 2 and 3, there are no demonstrated technologies or characterization data for antimony in K021 wastewaters or nonwastewaters. Antimony was present, however, in untreated K019 and K048-K052

wastes, in the scrubber water residuals from the treatment of K019, and in the ash residuals of K048-K052. Because the Agency does not know what concentration of antimony is normally found in untreated K021 waste, it assumes that there is not more antimony in K021 untreated waste than there was in K019 or K048-K052 untreated waste. (The concentration of antimony in the untreated K019 was 24 mg/l, and the concentration in the untreated K048-K052 waste was 9 mg/l.) Based on this assumption, there should be no more antimony in either the scrubber water or incinerator ash from the treatment of K021 waste than is found in scrubber water and incinerator ash from the treatments of K019 and K048-K052, respectively. (The treated values for antimony from incineration of K019 are 0.38 mg/l for scrubber water and <0.06 mg/l TCLP for incinerator ash. For K048-K052 incinerator ash, antimony was found at 0.06 to 0.09 mg/l TCLP.) Therefore, the Agency is setting treatment standards for antimony in K021 scrubber water based on the performance data from incineration of K019 waste (see Tables 4-1 through 4-6); for antimony in K021 incinerator ash, the Agency is setting standards based on the stabilization of K048-K052 (see Table 4-8). If a facility should have to treat K021 with antimony levels significantly higher than the levels found in K019 or in K048-K052,
the sources of antimony transfer for K021, this facility may petition for a variance. Additionally, the Agency is setting treatment standards for antimony in the nonwastewater residuals of K021 from the vitrification of arsenic because available literature (Tooley 1984) has revealed that antimony is often used as a component in glass (i.e., vitrified).

The accuracy-adjusted concentration for a constituent in a matrix is the analytical result multiplied by the correction factor (the reciprocal of the recovery fraction).* For example, if Compound A is measured

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*The recovery fraction is the ratio of (1) the measured amount of constituent (or surrogate) in a spiked aliquot minus the measured amount of constituent (or surrogate) in the original unspiked aliquot to (2) the known amount of constituent (or surrogate) added to spike the original aliquot. (Refer to the Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT").)

at 2.55 mg/l and the recovery is 85 percent, the accuracy-adjusted concentration is 3.00 mg/l:

2.55 mg/l	x	1/0.85	=	300 mg/l
(analytical result)		(correction factor)		(accuracy-adjusted concentration)

After treatment performance data are corrected for accuracy, the arithmetic average of the corrected data is calculated for each constituent. In cases where the constituent is not detected above its detection limit, the detection limit is used to calculate the average constituent concentration in the treated waste. The next step in calculating treatment standards is to determine the variability factor for each regulated constituent. EPA is using a variability factor of 2.8 for all of the volatile organic constituent treatment standard calculations for K021 nonwastewaters because treatment performance values for each constituent transferred from K019 was below the detection limit in the K019 incinerator ash. All of the variability factors for constituents in K021 wastewaters are also 2.8 because the treatment performance for each constituent transferred from K019 was below the detection limit.

The variability factor for antimony in nonwastewaters is 2.8 because treatment performance from incineration of K048-K052 is below the detection limit. Also, treatment performance for vitrification is from one data set, making the variability factor 2.8. For antimony treatment standards in wastewaters, the variability factor has been calculated to be 1.26.

BDAT treatment standards are calculated for each constituent by multiplying the arithmetic mean of accuracy-adjusted concentrations by the variability factor of each constituent. Table 7-3 summarizes all treatment standards being established for K021 waste. Note that concentrations are expressed in terms of mg/kg and mg/l for nonwastewaters and wastewaters, respectively.

Table 7-1 Calculation of Nonwastewater Treatment Standards for Constituents Proposed for Regulation in K021 Waste

Constituent	Treated average nonwastewater concentration (mg/kg)	Analytical recovery (%)	Correction factor (reciprocal of analytical recovery)	Corrected analytical values	Variability factor	Treatment standard (mg/kg)
Volatile organics						
Carbon tetrachloride	< 2.0	91	1.1	2.2	2.8	6.2
Chloroform	< 2.0	91	1.1	2.2	2.8	6.2
Metals	TCLP (mg/l)					TCLP (mg/l)
Antimony	<0.060	74 [a]	1.35	0.08	2.8	0.23

[a] No analytical recoveries are available for antimony from K019. Therefore, the analytical recovery for antimony is taken from K048-K052 metals data. K048-K052 are also organic nonwastewaters.

Table 7-2 Calculation of Wastewater Treatment Standards for Constituents Proposed for Regulation in K021 Waste

Constituent	Treated average wastewater concentration (mg/l)	Analytical recovery (%)	Correction factor (reciprocal of analytical recovery)	Corrected analytical values	Variability factor	Treatment standard (mg/l)
Volatile organics						
Carbon tetrachloride	0.0175	86	1.16	0.0204	2.8	0.057
Chloroform	0.0124	100	1.0	0.0124	3.71	0.046
Metals						
Antimony	0.38	80.7[a]	1.24	0.47	1.26	0.6

[a] No analytical recovery information is available for metals in K019; therefore, the average of the analytical recoveries for metals in K048-K052 were used. K048-K052 are also organic nonwastewaters.

Table 7-3 Treatment Standards for K021 Waste

Constituent	Nonwastewaters: Total concentration (mg/kg) (Grab sample)	Nonwastewaters: TCLP leachate concentration (mg/l) (Grab sample)	Wastewaters: Total concentration (mg/l) (Composite sample)
Volatile organics			
Carbon tetrachloride	6.2	NA	0.057
Chloroform	6.2	NA	0.046
Metals			
Antimony	NA	0.23	0.60

NA = Not applicable.

8. REFERENCES

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APPENDIX A

Wastewater Standards for U&P Wastes (USEPA 1990b)

Carbon Tetrachloride (U221). The data available for carbon tetrachloride were compiled from the WERL database, BDAT Solvents Rule data, and literature WAO and PACT[a] data. These data are presented in Table 4-9. Demonstrated treatment technologies included AL, AS, AS+Fil, AirS, BT, chemically assisted clarification (CAC), GAC, PACT[a], RO, SS, and WOx. The treatment performance data represents bench-, pilot, and full-scale studies. The resulting effluent concentrations ranged from 0.200 ppb to 12,000 ppb.

The proposed and promulgated BDAT standard was set using BT technology and an achievable effluent of 10 ppb. BT was selected as BDAT because it represents full-scale data developed from ITD sampling and was used as part of the BDAT Solvents Rule. The effluent concentration achievable by this technology is supported by similar effluent concentrations from the SS and GAC treatment performance data.

The resulting BDAT treatment standard for carbon tetrachloride is 0.057 ppm as shown in Table 6-10.

TABLE 4-9
WASTEWATER TREATMENT PERFORMANCE DATA
FOR CARBON TETRACHLORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		0-100	14	11.000		84	WERL
AL	Pilot	203A		0-100	14	15.000		78	WERL
AS	Pilot	203A		0-100	14	13.000		81	WERL
AS	Full	1B		100-1000	6	16.000		88	WERL
AS	Pilot	206B		0-100	20	0.200		99.67	WERL
AS	Full	975B		0-100		3.000		94.8	WERL
AS	Bench	202D		10000-100000		130.000		99.32	WERL
AS	Full	6B		100-1000	3	10.000		96.7	WERL
AS	Pilot	241B		100-1000	5	5.000		98.3	WERL
AS	Pilot	240A		0-100	12	4.000		90.7	WERL
AS+Fil	Full	6B		1000-10000	14	10.000		99.09	WERL
AS+Fil	Full	6B		10000-100000	2	10.000		99.96	WERL
AirS	Bench	1328E		10000-100000	5	7600.000		89	WERL
* BT	Full	P225		51-44000	17	10.000			BDAT # *
BT	Full	REF4		95	1	5.500			BDAT #
CAC	Pilot	203A		100-1000	14	101.000		0	WERL
GAC	Full	1264B		0-100		1.000		87	WERL
GAC	Full	237A		0-100	1	10.000		89	WERL
PACT	Bench	242E		1000-10000		30.000		98.5	WERL
PACT	Bench	Zimpro		860	1	1.000		99.9	WAO
PACT	Bench	Zimpro		2000	1	30.000		98.5	WAO
RO	Pilot	323B		100-1000	1	2.000		98	WERL
SCOx	Pilot	65D		100-1000		20.000		96.5	WERL
SS	Full	251B		10000-100000	10	5.000		99.99	WERL
SS	Full	251B		1000-10000	10	10.000		99.41	WERL
TF	Pilot	203A		0-100	14	26.000		62	WERL
TF	Pilot	240A		0-100	12	4.000		90.7	WERL
WOx	Bench	Zimpro		4330000	1	12000.000		99.7	WAO
WOx	Full	242E		1000000		2000.000		99.92	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Chloroform (U044). Several sources of wastewater treatment performance data were available for chloroform including data from the ITD, and WERL databases and literature WAO and PACT[a] data. These data are presented in Table 4-15. Demonstrated treatment technologies included AL, AS, AS+Fil, AirS, CAC, CAC+AirS, chemical oxidation (ChOx), GAC, PACT[a], RO, SS, TF, and WOx. The treatment performance data represents bench-, pilot-, and full-scale data.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in that database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

The BDAT for chloroethane is SS and using the ITD median long term average and ITD Option 1 variability factors, a BDAT treatment standard equal to the ITD limit was calculated as shown in Table 4-173. The BDAT treatment standard for chloroethane is 0.046 ppm.

TABLE 4-15
WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1607B		0-100	3	9.000		90.1	WERL
AL	Full	1B		100-1000	6	26.000		96.8	WERL
AL	Pilot	203A		100-1000	14	53.000		61	WERL
AL	Full	141A		100-1000		16.000		92.3	WERL
AL	Full	1607B		100-1000	2	10.000		97.4	WERL
AL	Full	1607B		100-1000	3	130.000		86	WERL
AL	Full	1607B		100-1000	14	31.000		77	WERL
AL	Pilot	203A		100-1000	3	20.000		80	WERL
AS	Full	1B		0-100	7	30.000		77	WERL
AS	Full	6B		100-1000	5	6.000		86	WERL
AS	Full	1B		0-100	3	10.000		97.7	WERL
AS	Full	6B		100-1000		200.000		99.43	WERL
AS	Bench	202D		10000-100000		1.200		61	WERL
AS	Full	234A		0-100	6	21.000		62	WERL
AS	Full	1B		0-100	7	1.000		75	WERL
AS	Full	375E		0-100	6	59.000		51	WERL
AS	Full	1B		100-1000		2.000		93.8	WERL
AS	Full	975B		0-100		2.300		72	WERL
AS	Full	234A		0-100		0.500		98.4	WERL
AS	Full	234A		0-100	3	10.000		98.2	WERL
AS	Full	6B		100-1000	3	2.400		46	WERL
AS	Full	238A		0-100	3	50.000		86	WERL
AS	Full	1607B		100-1000	2	40.000		96.9	WERL
AS	Full	1607B		1000-10000	20	3.600		97.4	WERL
AS	Pilot	206B		100-1000	7	20.000		78	WERL
AS	Full	375E		0-100		1.600		65	WERL
AS	Full	1587E		0-100	5	44.000		85	WERL
AS	Pilot	241B		100-1000		1.300		84	WERL
AS	Full	234A		0-100	14	18.000		87	WERL
AS	Pilot	203A		100-1000	27	19.000		98.7	WERL
AS	Full	6B		1000-10000	29	38.000		53	WERL
AS	Full	201B		0-100		1.300		65	WERL
AS	Full	234A		0-100	14	2.000		98	WERL
AS	Pilot	240A		1000-10000	3	10.000		99.41	WERL
AS+Fil	Full	6B		100-1000	14	10.000		95.8	WERL
AS+Fil	Full	6B		100000-1000000	5	16000.000		93.1	WERL
AirS	Bench	1328E		0-100		1.400		98.2	WERL
AirS	Pilot	369A		0-100	1	13.000		77	WERL
AirS	Pilot	213B		10000-100000	5	4400.000		83	WERL
AirS	Bench	1328E							

TABLE 4-15 (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AirS	Pilot	225B		0-100	1	0.130		98.9	WERL
AirS	Bench	17A		0-100		2.600		96.9	WERL
AirS	Bench	17A		1000-10000		110.000		91.7	WERL
AirS	Bench	17A		0-100		3.900		88	WERL
AirS	Bench	17A		100-1000		4.200		98.6	WERL
AirS	Pilot	210B		100-1000	1	1.000		99.2	WERL
AirS	Bench	17A		100-1000		3.700		98.6	WERL
AirS	Bench	1328E		100-1000	5	34.000		84	WERL
AirS	Pilot	434B		1000-10000	4	41.000		98	WERL
CAC	Pilot	203A		100-1000	14	106.000		22	WERL
CAC+AirS	Full	1833D		0-100	25	0.200		89	WERL
ChOx	Bench	640E		100-1000	2	7.000		96	WERL
ChOx	Bench	640E		100-1000	1	3.000		99	WERL
ChOx (Oz)	Pilot	331D		0-100		46.000		37	WERL
ChOx (Oz)	Pilot	331D		0-100		2.800		35	WERL
GAC	Full	1264B		0-100		1.000		87	WERL
GAC	Pilot	331D		0-100		1.000		98.6	WERL
GAC	Full	245B		100-1000	1	10.000		97.6	WERL
GAC	Full	237A		100-1000	1	10.000		98.1	WERL
GAC	Full	245B		100-1000	1	10.000		96.2	WERL
PACT	Bench	242E		0-100		20.000		47	WERL
PACT	Bench	Zimpro		1470	1	1.000		99.9	WAO
PACT	Bench	Zimpro		38	1	20.000		47	WAO
RO	Pilot	180A		0-100		0.890		71	WERL
RO	Full	250B		1000-10000		110.000		94.5	WERL
RO	Full	250B		100-1000		53.000		87	WERL
SCOx	Pilot	65D		100-1000		1.700		99.83	WERL
* SS	Full	415T	10	7330-1088000	15	10.500			ITD-L *
* SS	Full	913	10	28700-200000	14	129.200			ITD-L *
SS	Full	6B		100000-1000000	15	10.000		99.99	WERL
SS	Full	6B		10000-100000	2	120.000		99.88	WERL
SS	Full	251B		1000000	10	6000.000		99.39	WERL
SS	Full	251B		100000-1000000	10	9600.000		96.4	WERL
TF	Pilot	240A		0-100	14	11.000		89	WERL
TF	Full	1B		0-100	4	14.000		86	WERL
TF	Pilot	203A		100-1000	14	102.000		24	WERL
WOx	Bench	Zimpro		4450000	1	3000.000		99.9	WAO
WOx	Bench	Zimpro		270000	1	1000.000		99	WAO

Antimony. Two sources of wastewater treatment performance data were available for antimony, including data from the ITD-CMDB and WERL database. These data are presented in Table 4-118. Demonstrated treatment technologies included AS, CAC, L+Sed, and L+Sed+Fil. The treatment performance data represents bench- and full-scale studies.

The treatment performance data available from the ITD-CMDB were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD-CMDB represents industry wide treatment performance data which were collected as part of ITD's effluent guidelines work. These data are therefore a good reflection of the metals industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD-CMDB data were carefully screened prior to inclusion in that database. These data were used in determining ITD promulgated limits.

(3) In addition, the ITD-CMDB data have been challenged in court and were upheld. These data therefore represent a reviewed and accepted source of treatment performance data.

The BDAT for antimony is lime conditioning followed by sedimentation and filtration (L+Sed+Fil) and using the ITD mean long term average and ITD-CMDB variability factor, a BDAT treatment standard equal to the ITD 1-day maximum limit was calculated as shown in Table 6-10. The BDAT treatment standard for antimony is 1.9 ppm.

TABLE 4-118
WASTEWATER TREATMENT PERFORMANCE DATA
FOR ANTIMONY

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	1B		0-1000	6	58.000		59.00	WERL
AS	Full	975B		100-1000		59.000		66.00	WERL
AS	Full	201B		0-100	11	6.000		54.00	WERL
AS	Full	1B		0-100	2	6.000		68.00	WERL
AS	Full	1B		0-100	6	5.000		44.00	WERL
AS	Full	1B		0-100	6	2.000		60.00	WERL
AS	Full	1B		0-100	6	2.000		50.00	WERL
AS	Full	1B		0-100	4	14.000		72.00	WERL
AS	Full	1B		0-100	6	6.000		50.00	WERL
AS	Full	1B		1000-10000	1	200.000		88.00	WERL
CAC (B)	Bench	638B		8500		700.000			ITD-CMDB
L+Sed	Full			8500		470.000			ITD-CMDB
* L+Sed+Fil	Full								